

# **Public Health Assessment**

Gulf States Utilities Company

<a/k/a> North Ryan Street Facility

Lake Charles, Calcasieu Parish, Louisiana

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Prepared by

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## LIST OF ACRONYMS

<b>ATSDR</b>	Agency for Toxic Substances and Disease Registry
<b>BHC</b>	Beta hexachlorocyclohexene
<b>CAP</b>	Community Assistance Panel
<b>CERCLA</b>	The Comprehensive Environmental Response, Compensation, and Liability Act
<b>CLEAN</b>	Calcasieu League for Environmental Action Now
<b>CREG</b>	Cancer Risk Evaluation Guide
<b>DNR</b>	Department of Natural Resources
<b>DWEL</b>	Drinking Water Effect Level
<b>EE/CA</b>	Engineering Evaluation and Cost Analysis
<b>EMEG</b>	Environmental Media Evaluation Guides
<b>EPA</b>	Environmental Protection Agency
<b>GSU</b>	Gulf States Utilities
<b>HARP</b>	Health Activities Recreation Panel
<b>HCB</b>	Hexachlorobenzene
<b>HCBD</b>	Hexachlorobutadiene
<b>LDEQ</b>	Louisiana Department of Environmental Quality
<b>LDHH</b>	Louisiana Department of Health and Hospitals
<b>LDOTD</b>	Louisiana Department of Transportation and Development
<b>LTHA</b>	Lifetime Health Advisory
<b>LOAEL</b>	Lowest Observed Adverse Effect Level
<b>MCL</b>	Maximum Contaminant Level (µg/L)
<b>MRL</b>	Minimal Risk Level
<b>MW-6</b>	Monitoring Well #6
<b>NA</b>	Not Available
<b>ND</b>	Not Detectable
<b>NOAEL</b>	No Observed Adverse Effect Level
<b>NPL</b>	National Priorities List
<b>OCDD</b>	Octa-chlorodibenzo-dioxin
<b>OPH</b>	Louisiana Office of Public Health
<b>PAHs</b>	Polycyclic Aromatic Hydrocarbons
<b>PCBs</b>	Polychlorinated Biphenyls
<b>RDA</b>	Recommended Daily Allowances
<b>RfD</b>	Reference Dose
<b>RI</b>	Remedial Investigation
<b>RI/FS</b>	Remedial Investigation and Feasibility Study
<b>RMEG</b>	Environmental Media Evaluation Guide based on EPA's RfD or RfC
<b>SARA</b>	Superfund Amendments and Reauthorization Act
<b>SMCL</b>	Secondary Maximum Contaminate Level
<b>SSI</b>	Screening Site Investigation

<b>TCDD</b>	2,3,7,8 tetra-chlorodibenzo-para-dioxin
<b>TCDF</b>	Tetra-chlorodibenzo-para-furan
<b>TEQ</b>	Toxic Equivalency Factor
<b>VOCs</b>	Volatile Organic Compounds
<b>bgs</b>	Below groundwater surface
<b>ft</b>	Foot, Feet
<b>in</b>	Inches
<b>kg</b>	Kilogram
<b>L</b>	Liters
<b>mg</b>	Milligram
<b>mg/kg</b>	Milligrams per kilogram
<b>pg</b>	Picogram
<b>ppb</b>	Parts per billion: microgram per liter ( $\mu\text{g/L}$ water), Microgram per kilogram ( $\mu\text{g/kg}$ soil)
<b>ppm</b>	Parts per million: milligrams per liter ( $\text{mg/L}$ water), Milligrams per kilogram ( $\text{mg/kg}$ soil)
<b>yds</b>	Yards
<b><math>\mu\text{g}</math></b>	Microgram

## DEFINITIONS OF SELECTED TERMS

### **Aquifer**

An underground geological formation, or group of formations, containing usable amounts of groundwater that can supply wells and springs.

### **ATSDR**

The Agency for Toxic Substances and Disease Registry. The ATSDR is a federal health agency in Atlanta, Georgia that deals with hazardous substances and waste site issues. ATSDR gives people information about harmful chemicals in their environment and tell people how to protect themselves from coming into contact with chemicals.

### **Background Level**

A typical or average level of a chemical in the environment. *Background* often refers to naturally occurring or uncontaminated levels.

### **Carcinogen**

A substance that has the potential to cause cancer.

### **CERCLA**

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980, also known as Superfund. This is the legislation that mandates ATSDR public health assessment activities.

### **Cancer Risk Evaluation Guides (CREGs)**

CREGs are estimated contaminant concentrations that would be expected to cause no more than one excess cancer in a million ( $10^{-6}$ ) persons exposed over their lifetime. ATSDR's CREGs are calculated from U.S. EPA's cancer potency factors (CPFs).

### **Comparison Values**

Estimated contaminant concentrations in specific media that are not likely to cause adverse health effects, given a standard daily ingestion rate and standard body weight. The *comparison values* are calculated from the scientific literature available on exposure and health effects.

### **Concentration**

The amount of one substance dissolved or contained in a given amount of another. For example, sea water contains a higher concentration of salt than fresh water.

### **Contaminant**

Any substance or material that enters a system (the environment, human body, food, etc.) where it is not normally found.

**Dermal**

Referring to the skin. *Dermal* absorption means absorption through the skin.

**Dose**

The amount of a substance to which a person is exposed. *Dose* often takes body weight into account.

**DWEL**

Drinking Water Equivalent Level. Protective level of exposure related to potentially non-carcinogenic effects of chemicals that are also known to cause cancer.

**Environmental Contamination**

The presence of hazardous substances in the environment. From the public health perspective, *environmental contamination* is addressed when it potentially affects the health and quality of life of people living and working near the contamination.

**Environmental Media Evaluation Guides (EMEGs)**

EMEGs are based on ATSDR minimal risk levels (MRLs) that consider body weight and ingestion rates. An EMEG is an estimate of daily human exposure to a chemical (in mg/kg/day) that is likely to be without noncarcinogenic health effects over a specified duration of exposure to include acute, intermediate, and chronic exposures.

**EPA**

U.S. Environment Protection Agency. The federal agency that develops and enforces environmental laws to protect the environment and the public's health.

**Exposure**

Contact with a chemical by swallowing, by breathing, or by direct contact (such as through the skin or eyes). *Exposure* may be short term (acute) or long term (chronic).

**Health Consultation**

A response to a specific question or request for information pertaining to a hazardous substance or facility (which includes waste sites). It often contains a time-critical element that necessitates a rapid response; therefore, it is a more limited response than an assessment.

**Ingestion**

Swallowing (such as eating or drinking). Chemicals can get in or on food, drink, utensils, cigarettes, or hands where they can be ingested. After *ingestion*, chemicals can be absorbed into the blood and distributed throughout the body.

**Inhalation**

Breathing. Exposure may occur from inhaling contaminants because they can be deposited in the lungs and absorbed into the blood.

**LDEQ**

Louisiana Department of Environmental Quality

**LDHH**

Louisiana Department of Health and Hospitals

**LOAEL**

Lowest Observed Adverse Effect Level. The lowest dose in an experiment which produced an observable adverse effect.

**LTHA**

The Lifetime Health Advisory represents a contaminant concentration that EPA considers to be protective of noncarcinogenic health effects during a lifetime (70 years) of exposure.

**LTR**

Louisiana Tumor Registry

**Media**

Soil, water, air, plants, animals, or any other parts of the environment that can contain contaminants.

**Maximum Contaminant Level (MCL)**

The MCL is the drinking water standard established by U.S. EPA. It is the maximum permissible level of a contaminant in water that is delivered to the free-flowing outlet. MCLs are considered protective of public health over a lifetime (70 years) for individuals consuming 2 liters of water per day.

**mg/L**

Milligrams per liter (a measure of concentration in water, 1 mg/L is equal to 1 part-per-million and 1000 Fg/L)

**Fg/L**

Micrograms per liter (a measure of concentration in water, 1 Fg/L is equal to 1 part-per-billion and 0.001 mg/L).

**mg/kg**

Milligrams per kilogram (a measure of concentration in soil or tissue, 1mg/kg is equal to 1000 Fg/kg).

**Fg/kg**

Micrograms per kilogram (a measure of concentration in soil or tissue, 1 Fg/kg is equal to 0.001 mg/kg).

**Minimal Risk Level (MRL)**

An *MRL* is defined as an estimate of daily human exposure to a substance that is likely to be without an appreciable risk of adverse effects (noncancer) over a specified duration of exposure. *MRLs* are derived when reliable and sufficient data exist to identify the target organ(s) of effect or the most sensitive health effect(s) for a specific duration via a given route of exposure. *MRLs* are based on noncancer health effects only. *MRLs* can be derived for acute, intermediate, and chronic duration exposures by the inhalation and oral routes.

**No Apparent Public Health Hazard**

This public health conclusion category is used for sites where human exposure to contaminated media may be occurring, may have occurred in the past, and/or may occur in the future, but the exposure is not expected to cause any adverse health effects.

**National Priorities List (NPL)**

The U.S. Environmental Protection Agency's (U.S. EPA) listing of sites that have undergone preliminary assessment and site inspection to determine which locations pose immediate threat to persons living or working near the release. These sites are most in need of cleanup.

**OPH**

Office of Public Health

**Parts per billion (ppb)/ Parts per million (ppm)**

Units commonly used to express low concentrations of contaminants. As example of each, one part per billion (ppb) of trichloroethylene (TCE) equals one drop of TCE mixed in a competition-size swimming pool and one part per million (ppm) equals one ounce of trichloroethylene (TCE) in one million ounces of water.

**Potentially Exposed**

The condition where valid information, usually analytical environmental data, indicates the presence of contaminant(s) of a public health concern in one or more environmental media contacting humans (i.e., air, drinking water, soil, food chain, surface water), and there is evidence that some of those persons have an identified route(s) of exposure (i.e., drinking contaminated water, breathing contaminated air, having contact with contaminated soil, or eating contaminated food).

**PRP**

Potentially Responsible Party. A company, government or person that is responsible for causing the pollution at a hazardous waste site. PRP's are expected to help pay for the clean up of a site.

**Public Health Assessment**

The evaluation of data and information on the release of hazardous substances into the

environment in order to assess any current or future impact on public health, develop health advisories or other recommendations, and identify studies or actions needed to evaluate and mitigate or prevent human health effects; also, the document resulting from that evaluation.

### **Public Health Hazard**

This public health conclusion category is used for sites that pose a public health hazard due to the existence of long-term exposures to hazardous substances or conditions that could result in adverse health effects.

### **RDA's**

Recommended Dietary Allowances. The levels of intake of essential nutrients that, on the basis of scientific knowledge, are judged by the Food and Nutrition Board to be adequate to meet the known nutrient needs of practically all healthy persons.

### **Reference Dose (RfD)**

The value used by U.S. EPA as an estimate of daily exposure (mg/kg/day) to the general human population (including sensitive populations) that is likely to be without appreciable risk of harmful effects during a lifetime of exposure.

### **Reference Dose Media Evaluation Guides (RMEGs)**

ATSDR derives RMEGs from U.S. EPA's oral reference doses. The RMEG represents the concentration in water or soil at which daily human exposure is unlikely to result in adverse noncarcinogenic effects.

### **Risk**

In risk assessment, the probability that something will cause injury, combined with the potential severity of that injury.

### **Route of Exposure**

The way in which a person may contact a chemical substance. For example, drinking (ingestion) and bathing (skin contact) are two different *routes of exposure* to contaminants that may be found in water.

### **SEET**

Section of Environmental Epidemiology and Toxicology

### **SMCL**

Secondary Maximum Contaminant Level. Maximum level of a contaminant in water delivered to the free flowing outlet of the ultimate user, or of contamination resulting from corrosion of piping and plumbing caused by water quality.

### **Superfund**

Another name for the Comprehensive Environmental Response, Compensation, and Liability

Act of 1980 (CERCLA), which created ATSDR.

### **Volatile Organic Compounds (VOCs)**

Substances containing carbon and different proportions of other elements such as hydrogen, oxygen, fluorine, chlorine, bromine, sulfur, or nitrogen; these substances easily become vapors or gases. A significant number of the *VOCs* are commonly used as solvents (paint thinners, lacquer thinners, degreasers, and dry cleaning fluids).

Several government organizations, Environmental Protection Agency (EPA), International Agency for Research on Cancer (IARC) and the National Toxicology Program (NTP) have established cancer classifications for toxic chemicals. In this document, we have adopted EPA's cancer classification which is based on animal and human epidemiological studies, and defined below:

Class A	The chemical is a human carcinogen
Class B1	Probable human carcinogen (based on limited human but sufficient animal data)
Class B2	Probable human carcinogen (based on inadequate human but sufficient animal data)
Class B2/C	Under consideration for placement into either B <sub>2</sub> or the C classification
Class C	Possible human carcinogen (no human data and limited animal studies)

## **I. Summary**

Gulf States Utilities Inc. (GSU) (aka North Ryan Street Facility) is situated on the Calcasieu River, southeast of Two O'Clock Point and northeast of the city of Lake Charles. The site consists of a 3 - 4 acre east service yard and a 16 acre west service yard. These yards are divided by North Ryan Street. This site currently functions as a storage and repair facility for GSU, a subsidiary of Entergy Services, Inc. It was proposed to the Environmental Protection Agency's (EPA) National Priorities List (NPL) for hazardous waste sites in February 1995. The 16 acre west service yard site is contained entirely within a well maintained fence, and access to the site is limited to approximately 153 employees of GSU. The 3 - 4 acre east service yard is closed, but not fenced. Public access is unrestricted. The Louisiana Department of Health and Hospitals/Office of Public Health (OPH)/Section of Environmental Epidemiology and Toxicology(SEET) in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR) has prepared this public comment release of the GSU Public Health Assessment after reviewing currently available environmental data.

Prior to its purchase by GSU in 1927, this site had been used as a coal gasification plant from 1916-1926. GSU purchased the site and operated the coal gasification plant between 1927 and 1932. From 1932-1980, the site was used as a landfill and storage area for various materials including electrical poles, transformers, oils, electrical equipment, and old appliances. The landfill was closed in 1980 and covered with soil and shells. The entire site was subsequently used as a storage facility. In 1988, the Louisiana Department of Environmental Quality (LDEQ) was contacted to investigate oily material found in a trench dug along the north side of the storage yard. Coal tar and fuel pits were discovered on the site. This site is located next to the Greater Lake Charles Water Company and some municipal wells previously existed on the site, but have since been closed.

Three sources of hazardous substances were located at this site; the coal gasification plant, two former fuel oil pits, and the 6 acre marsh area used as the landfill. A major contaminant associated with this site is coal tar, which consists of volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs).

OPH conducted an Environmental Health Education Program in 1993, along with the issuance of a public health informational fish and seafood advisory for the entire Calcasieu River System from the salt barrier above Lake Charles to the Gulf of Mexico. Water bodies near the site have been used in the past and present for recreational activities. These include: waterskiing, boating, and fishing. Community concerns include recreational sports and subsistence fishing along the banks near the site. The community proposed that the area be posted and that community health education be implemented. Representatives from OPH attended a public meeting on January 19, 1999. Residents expressed concerns about the health effects of exposure to PAHs and PCBs, the safety of drinking water and food grown in the local gardens, respiratory illnesses, and the presence of skin rashes.

Contamination of soil, sediment, as well as surface and ground water in the past and present pose a public health hazard to on-site workers, trespassers and residents. Residents using the shallow 200 foot (ft) aquifer as a private source of drinking water may be exposed to contamination. Alternative water supplies are currently available and most shallow wells have been closed. Additional sampling of contaminants along the Calcasieu River and River Road is encouraged to identify further exposure pathways.

The data and information developed in this public health assessment have been evaluated by the health activities recommendation panel for appropriate follow-up public health actions. The following health actions were recommended. Community education and community involvement were needed to describe the health effects of exposure to site related contaminants and explain the findings of the public health assessment to the public. Health professionals education was recommended so that local physicians would be aware of symptoms related to exposure to site contaminants.

### **Is the site being cleaned up?**

Source material and contaminated soils located in the western utility yard, known as the “exposed tar area” and the “storm sewer area”, will be cleaned up first. The exposed tar area will be treated using an in-situ thermal treatment process. The contaminated soils in the storm sewer area will be excavated to a depth of five feet, characterized and, following treatment, if deemed necessary, transported to an appropriate off-site disposal facility that is in compliance with the off-site rule. The contingency alternative to the in-situ thermal desorption is excavation and off site treatment or disposal.

The remedial alternative chosen for Ground Water Operable Unit Number 1, which will be cleaned up upon completion of the removal action at the exposed tar area, is alternative two. This alternative includes ground water use restrictions, monitored natural attenuation of ground water, surface water and public water supply monitoring.

The Entergy Corporation will implement the removal action at the site under oversight by the U.S. Environmental Protection agency Region 6 (EPA).

## **Purpose and Health Issues**

The Superfund Amendments and Reauthorization Act (SARA) to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 directs the Agency for Toxic Substances and Disease Registry (ATSDR) to perform specific public health activities associated with actual or potential exposures to hazardous substances released into the environment. Among those activities, ATSDR was mandated to perform a public health assessment for each facility or site listed on or proposed to the National Priorities List (NPL).

The Louisiana Department of Health and Hospitals/Office of Public Health (OPH) is conducting this public health assessment of the Gulf States Utilities (GSU) west yard and surrounding area to determine the public health significance of the site. OPH has reviewed environmental data and responded to initial community concerns. Lastly, this public health assessment (PHA) contains recommendations to reduce or prevent site-related exposure that might result in adverse health effects.

## **I. Background and Statement of Issues**

### **A. Site Description and History**

The Gulf States Utilities (GSU) site is also called the North Ryan Street Facility or the Lake Charles Manufactured Gas Plant Site. It is owned and actively used by Gulf States Utilities Company (GSU), a subsidiary of Entergy Services Inc. GSU is situated on the Calcasieu River, northeast of Lake Charles (Appendix A, Figure 1). It is approximately 1.5 miles north of Highway I-10 and 3/4 miles east of Louisiana Highway 3077. The site's address is 303 North Ryan Street, Lake Charles, Calcasieu Parish, Louisiana. The site is defined by the coordinates 30°14'27" north latitude and 93°13'09" west longitude.

The site is bounded to the north by River Road and the Calcasieu River and to the southwest by the Greater Lake Charles Water Company and the wastewater treatment plant. The site is bounded to the west by a cypress wetland, which is the property of the City of Lake Charles and to the east by residential areas. North of the GSU property is the Calcasieu River. A barge containing Bunker C, a type of fuel oil, reportedly sank in the Calcasieu River west of the property.

The lower Calcasieu River system has been impacted by several industries (petrochemical, agrochemical, etc.) which have historically discharged waste into the Calcasieu River and its tributaries. Several studies have been conducted on contamination within the Calcasieu Estuary. In 1986, the United States Geological Survey conducted a study to determine the levels and transport of toxic compounds in this river system [1]. In 1992, the Louisiana Office of Public Health (OPH) and the Louisiana Department of Environmental Quality (LDEQ) issued a joint informational advisory for fish and seafood consumption from within the river system, and advisories against swimming, wading, and water sports in Bayou D'Inde [1]. In March 1999, the Environmental Protection Agency (EPA) began a federally-led Remedial Investigation and Feasibility Study (RI/FS) of the Calcasieu Estuary sediments. In November 1999, the Agency for Toxic Substances and Disease Registry (ATSDR) performed an exposure assessment which concluded that Mossville residents had elevated blood dioxin levels [2].

A manufactured gas plant operated on a portion of the GSU west yard from 1916 -1932. The plant used coal to produce gas for lighting and heat. Coal tar was a byproduct of this process. This coal tar waste was land filled in what was a 6 acre marsh area to the west of the gas plant. This marsh area is located within what is currently called the west service yard. Until the 1980's, an outcropping of exposed tar was visible. The manufactured gas plant included a 16-acre west yard, west of North Ryan Street and a 4-acre east yard, east of North Ryan Street. When the manufactured gas plant closed, the west yard continued to be used as a landfill and a storage area. Various materials including electrical poles, transformers, transformer oils, electrical equipment, debris, and appliances were disposed of into the landfill area of the west service yard. In 1980, the landfill became full and the area was covered with soil and shells. The east service

yard was used as storage and has never been owned by Entergy. It is unfenced and no longer used for storage [3].

On July 20, 1988, workmen digging a trench along the north side of the west yard noticed an oily material flowing from the trench which was traced by LDEQ to the GSU west service yard. LDEQ also discovered several old pits containing waste tar, transformers, oils, and drums.

On September 19, 1989, GSU was ordered to submit a plan for determining the extent of contamination and remediation. As a result, three investigations by GSU were carried out. Phase I, II, and III investigations are dated December 1988, March 1989, and March 1990, respectively. In October 1990, a Screening Site Investigation (SSI) was performed by EPA. The site was proposed for the National Priorities List (NPL) in February 1995. GSU and the EPA completed an Administrative Order on Consent for clean up actions in February 1997 [3,4].

An Engineering Evaluation and Cost Analysis (EE/CA) and a RI/FS for Operable Unit 1 were completed in February of 1998 [5]. Operable Unit 1 addresses ground water. The Remedial Investigation (RI) activities performed during the investigation included the excavation of seven test pits, the drilling of 28 soil borings, the installation of six monitoring wells, and the collection of 22 sediment samples, 18 surface water samples, and 12 groundwater samples.

In March 1999, Addendum #1 to the RI and EE/CA was completed [6]. The objective of the Addendum was to further evaluate the connection between subsurface soil contamination and the river. In March 1999, the Baseline Risk Assessment was also completed. In January 1999 and January 2000, annual groundwater sampling reports were completed [7,8]. Domestic well water from 25 additional wells was sampled in April 1999.

Three sources of contaminants have been determined, the former manufactured gas plant which operated from 1916-1932, two former fuel oil pits used from 1900-1920, and the marsh area used by GSU as a landfill from 1932-1980. None of the disposal areas were contained; the coal tars were pumped into the marsh, the fuel oil stored in earthen pits, and the landfill covered with shells and used to create a base for the storage yard. No records of waste type, amount, location, or capacity of the pits were available. Fuel oil pits are located at the northern area of the site, near the Calcasieu River. Polychlorinated biphenyls (PCBs) were found in areas associated with landfill operations on the site. A storm water drain line from the site transported coal tar to the exit point in the river until 1995 when it was plugged.

## **B. Geology and Hydrogeology**

The GSU site geology consists of a surface fill layer which overlays a cohesive sandy clay layer. The fill was brought in to elevate the site and ranges from 1 - 12 feet (ft) deep. A pocket of sand up to 30 ft in height is present in the northwest corner of the site at a depth of 20 - 36 ft below ground surface (bgs). The EPA studied this sand pocket and determined that it did not provide a

subsurface pathway for contaminants to move to the Calcasieu River. The cypress wetland which is west of the GSU west service yard contains no fill.

The groundwater in the vicinity of GSU consists of shallow alluvial aquifers and the deeper Chicot Aquifer. The shallow aquifers are linked to the Calcasieu River and receive recharge waters from and discharge to the River. The Lake Charles area uses the Chicot Aquifer as its major water source. The Chicot Aquifer has three major sands at 200, 500, and 700 ft.

The City of Lake Charles obtains its water supply from seventeen water wells screened in either the 500 or 700 ft sands of the Chicot Aquifer. GSU is located adjacent to the Greater Lake Charles Water Company. Three municipal water wells which were screened in the 700 ft sands are located on GSU property and have been closed. Six other city wells are located within 300 - 400 yards (yds.) south of the site on Lake Charles Water Department property. Five of these wells are screened in the 500 ft sands and one is screened in the 700 ft sands.

Underneath the GSU site, the 200 ft sands of the Chicot Aquifer are not receiving recharges from the shallow aquifers. Soil borings, on-site and under the river, show a continuous clay layer that extends across the site and under the river bed. The clay makes it unlikely that site contaminants will migrate through the clay layers and potentially impact deeper ground water. The groundwater flows in a north to northwest direction toward the Calcasieu River. The monitoring wells south of the GSU site (up gradient) showed no contamination. The EPA concurred with the site contractor that homes to the south and east were up gradient of ground water.

Rural communities and the residences along River Road get their water from the 200 ft sands. As part of the RI, a list of registered wells was received from the Louisiana Department of Transportation and Development (LDOTD) in May 1997. From this list, 36 wells were counted within a 1 mile radius of the site. Four of these wells draw from the 200 ft sands while the remaining draws from the deeper sands of the Chicot Aquifer. A house-to-house well survey was conducted at residences down gradient (north and west) of the site. One domestic well 1/4 mile to the west installed to the depth of 306 ft was identified. This well was used by a group of homes and camps. As of 1998, municipal water service to these homes is being installed.

### **C. Site Visit**

On August 18, 1995, Health Assessors for Office of Public Health (OPH) conducted a site visit of the GSU site, along with representatives of Entergy, Gulf State Utilities, and LDEQ. Many of the employees from GSU were working on-site during the visit. The following observations were made:

- C The site is located in a sparsely populated section of the City of Lake Charles, Louisiana, near other industries. A small community, with the closest house approximately 500 yds. away from the site, is located to the east.

- C An eight-foot high fence with razor wire is maintained around the perimeter of the site, and provides a barrier to human and animal access. No signs of trespassing were observed.
- C The site is mostly covered with crushed shells and used as a storage facility for electrical equipment and transformers. Many transformers were raised off the ground on wooden pallets. An exposed tar spot (2 x 4 feet) was observed on-site.
- C The coal-tar pit was recessed and covered with a corrugated tin cover. Standing water was observed on-site.
- C The off-site trench, originally dug to install fiber optic cables, had been covered and there was no visual indication of contaminants.
- C The Calcasieu River is located across River Road from GSU, approximately 50 ft north of the site. Water runoff from the site flows to a ditch toward River Road and the river. In addition, during periods of high water, the Calcasieu River could easily overflow onto the site. The western border of the site is a cypress swamp flood plain or marsh.
- C Many people were seen fishing along River Road and some directly across the street from the site, near the outflow pipe of the Municipal Wastewater Treatment Plant.
- C A sheen of oily organic substance was visible in the river, floating on the water's surface near the site. Oil bubbles coming from beneath the water, near the outflow pipe, were observed.
- C Currently no wells are operable. The municipal wells on-site had been plugged and abandoned.

On June 30, 1999, a visit to the area outside of the GSU west yard fence was made. The fencing remains in excellent condition. The signs were posted by the EPA in December 1998 and observed and noted to be clearly visible. The signs read:

**WARNING**

Contaminated Sediments: No recreational activity recommended  
between these signs. Clean up pending.

For more information, contact U.S. EPA at 1-800-533-3508.

- One fisherman was observed fishing, even though the signs were visible.

#### **D. Demographics, Land Use and Natural Resources Use**

The GSU site is located in the northwestern section of Lake Charles, LA. The population within 5 miles of the site is 84,845 with a total of 35,127 households. GSU lies within the 70601 zip code and within census tract 0002, encompassing 1,397 residents. Approximately 94% of the residents are African American, 6% Caucasian, and less than 1% Asian (Appendix B, Table 1).

There are many industrial facilities located upstream from the GSU site. The site is bordered to the south by the Greater Lake Charles Water Treatment facilities, which supplies water to the surrounding area. To the east, the site is bordered by residential areas and several schools are located within or near the one mile radius.

The Calcasieu River is an important resource, including industrial (shipping) and recreational (fishing, swimming, boating) usage. Currently, there is an LDHH/OPH informational health advisory for the Calcasieu River from the Salt Barrier across from the site, extending to the Gulf of Mexico.

#### **E. Community Health Concerns**

In September 1995, OPH met with the Calcasieu Task Force to request that they serve as a Community Assistance Panel (CAP) for the GSU site. The Task Force had been initially established during Governor Buddy Roemer's administration and comprises a group of private citizens representing environmental concerns of the community and other stakeholders. Concerns that were discussed included the subsistence fishing of the poorer community members along River Road and whether the informational fish and seafood consumption advisory in effect for the Calcasieu Estuary should include recreational activities.

OPH gathered community health concerns during the first quarterly meeting with the EPA and Calcasieu League for Environmental Action Now (CLEAN) on March 23, 1999. During the meeting, members of the audience were encouraged to express their concerns to state and federal regulatory agencies. The following health concerns were raised by community members and will be addressed in the Community Health Evaluation section later in this document:

- People fish near the site, especially by the water treatment outflow pipe which releases warm, nutrient-rich water into the river, which attracts more fish. These people often are socioeconomic disadvantaged members of the community who subsistence fish.
- Signs should be posted to warn people of the presence of hazardous chemicals which they could be exposed to during activities such as fishing, as well as playing in water and sediment near the site.
- The informational fish and seafood consumption advisory in effect for the Calcasieu Estuary should include advice related to aquatic recreational activities as well.

Following the release of the ATSDR Mossville Blood Dioxin Exposure Assessment in November 1999, dioxin blood concentrations and related health effects have become a health concern throughout the city of Lake Charles and surrounding communities [2].

## IV. Discussion

Exposure to or contact with chemical contaminants drives the Agency for Toxic Substances and Disease Registry (ATSDR) public health assessment process. The release or disposal of chemical contaminants into the environment does not always result in exposure or contact. Chemicals only have the potential to cause adverse health effects if people actually come into contact with them. People may be exposed to chemicals by breathing, eating, or drinking a substance containing the contaminant, or by skin (dermal) contact with a substance containing the contaminant.

When people are exposed to chemicals, the exposure does not always result in adverse health effects. The type and severity of health effects that may occur in an individual as a result of contact with contaminants depend on the toxicologic properties of the contaminants, how much of the contaminant the individual is exposed to, how often and/or how long the individual was exposed, the manner in which the contaminant enters or contacts the body (breathing, eating, drinking, or skin/eye contact), and the number of contaminants to which an individual is exposed (combinations of contaminants). Once exposure occurs, characteristics of the individual, such as age, sex, nutritional status, genetics, life style, and health status influence how the individual absorbs, distributes, metabolizes, and excretes the contaminant. These factors and characteristics influence whether exposure to a contaminant could result in adverse health effects.

To assess the potential health risks associated with contaminants at this site, we compared contaminant concentrations to health assessment comparison values. Comparison values are media specific contaminant concentrations that are used to screen contaminants for further evaluation. Non-cancer comparison values are called environmental media evaluation guides (EMEGs) or reference dose media evaluation guides (RMEGs) and are respectively based on ATSDR's minimal risk levels (MRLs) or the Environmental Protection Agency's (EPA) reference doses (RfDs). MRLs and RfDs are estimates of a daily human exposure to a contaminant that is unlikely to cause adverse non-cancer health effects. Cancer risk evaluation guides (CREGs) are based on the EPA's chemical specific cancer slope factors and an estimated excess lifetime cancer risk of one in one million persons exposed for a lifetime. We used standard assumptions to calculate appropriate comparison values.

In some instances, we compare contaminant concentrations in water to EPA's maximum contaminant levels (MCLs). MCLs are chemical specific maximum concentrations allowed in water delivered to the users of a public water system; they are considered protective of public health over a lifetime (estimated 70 years) of exposure at an ingestion rate of two liters per day. MCLs may be based on available technology and economic feasibility. Although MCLs only apply to public water supply systems, we often use them to help assess the public health implications of contaminants found in water that is not intended for public consumption.

While exceeding a comparison value does not necessarily mean that a contaminant represents a

public health threat, it does suggest that the contaminant warrants further consideration. The public health significance of contaminants that exceed comparison values may be assessed by reviewing and integrating relevant toxicological information with plausible exposure scenarios. Estimated exposures may be compared to reported “No Observed” and “Lowest Observed” Adverse Effects Levels (NOAELs and LOAELs) and to known effect levels in humans, when available.

## **A. Environmental Contamination and Other Hazards**

The contaminants of concern in each medium are listed in Appendix B, Tables B-2 to B-15. These contaminants will be evaluated in the subsequent sections of the health assessment to determine whether exposure to them has public health significance.

These following sections present the analytical results for contaminants detected in off-site soil, sediment, surface water, and groundwater. Toxic equivalence products are calculated for media containing polycyclic aromatic hydrocarbons (PAHs). The data was obtained during the Screening Site Investigation (SSI) in 1992 [3], the Remedial Investigation and Engineering Evaluation/Cost Analysis (RI and EE/CA) field activities performed between February 3 - 24, 1997 [5], Addendum #1 to the RI and EE/CA Investigation Report March 1999 [6], annual groundwater monitoring results for 1998 and 1999 [7,8], and private well sampling conducted in April 1999. The ground water data is from quarterly monitoring performed during the weeks of June 22, September 8, and December 15, 1997. Surface water samples were also collected from the Calcasieu River during September 1997, groundwater monitoring [9]. Data collected prior to the SSI was not included in this report.

### ***1. On-Site Contamination***

#### ***a. Soils***

In 1997, seven surface soils were collected during the RI and EE/CA. The surface soil consists of gravel fill, which averages 4 feet (ft) in depth and has been brought in to cover the Gulf States Utilities (GSU) west yard. Sampling was discontinued by the EPA and its contractor because the pathway is not complete. The GSU employees maintain the gravel cover through regrading to eliminate exposure to subsurface contamination. This data was not evaluated for the Public Health Assessment (PHA).

In 1992, 16 subsurface soil samples were collected during the SSI. In February 1997, during the RI and EE/CA soil investigation, 28 soil borings were drilled. Six of the borings were completed as monitoring wells. In addition to the borings, seven test pit locations were sampled. The 1997 borings and test pit samples were collected between 5 and 10 ft below ground surface (bgs). In March 1998, nine additional subsurface soil samples were collected. In December 1998, 21 additional on-site subsurface soil samples were collected in the vicinity of monitoring well #6 (MW-6), in the northwest portion of the Gulf States Utilities (GSU) service yard. Samples were

collected to a depth of 20 ft. This sampling event was conducted to learn more about movement of PAHs through subsurface soil. The samples were analyzed for volatile organic compounds (VOCs), PAHs, polychlorinated biphenyls (PCBs), and metals.

The results from these sampling events which were from a depth of less than 6.5 ft are summarized and presented in Appendix B, Table B-2 and B-3. The tables also provide the comparison values and mean background concentrations of the samples collected. The GSU water table is encountered at a depth of around 6.5 ft. The construction activities which could result in subsurface soil exposure would be limited to subsurface soils above groundwater. Contamination has been found as deep as 17 ft.

Soil sampling indicates that benzene, PCBs, PAHs, and manganese exceeded the comparison values. Table B-3 in Appendix B highlights the toxic equivalence products for the PAHs detected in on-site subsurface soil. Each PAHs is assigned a toxic equivalence factor by which its cancer potency is estimated based on its relative potency to Benz(a) pyrene [10]. By using this concept, the cancer potency of the other carcinogenic PAHs can be estimated based on their relative potency to Benz(a)pyrene. The sum of the maximum of each PAHs multiplied by its toxicity equivalency factor is 4662 parts per million (ppm) which is greater than the Benz(a)pyrene soil comparison value of 0.1 ppm.

#### *b. On-Site Groundwater*

In February 1997, groundwater samples from the 12 monitoring wells were collected and analyzed for PAHs, VOCs, phenols, and metals. Six groundwater monitoring wells had been installed in Phase II of the GSU investigation and an additional six wells were installed as part of the RI and EE/CA investigation. Two of the 12 wells are actually off of the GSU property and in the Cypress wetland to the west. The wells, with the exception of one, which was abandoned because it had been installed through a sanitary sewer line, were sampled again in June, September, and December 1997. In August 1998 and July 1999, the wells were each sampled again. Metals were omitted from the list of analyses for the 1999 samples.

The location and depth of each well were planned to gather information about water quality, water flow direction, and vertical movement of water between subsurface soils. The wells were installed to total depths between 16 and 51.5 ft B.S. to monitor shallow and deep groundwater in the clay and shallow sand lenses within the clay at the site. Monitoring Well No. 6 (MW-6) monitors the discontinuous sand lense which is in the clay layer and contains visible liquid tar.

Analytical results and toxic equivalence products for groundwater samples are presented in Appendix B, Tables B-4 and B- 5. Results of the groundwater samples indicate exceedance of drinking water comparison values for acetone, benzene, ethylbenzene, toluene, arsenic, aluminum, barium, beryllium, lead, manganese, nickel, thallium, vanadium, and PAHs. The contaminants 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 2,4-dimethylphenol, 2-methylnapthalene and cobalt were found, but no comparison values exist for these contaminants.

Table B-5 in Appendix B highlights the toxic equivalence products for PAHs detected in on-site groundwater. The sum of the maximum concentration of each PAHs multiplied by its toxicity equivalency factor is 745 parts per billion (ppb) which is above the drinking water CREG of 0.005 ppb.

## ***2. Off-Site Contamination***

The EPA collected samples outside of the GSU west yard fence line to determine how far contamination had spread. Sediment samples were collected from three locations, the cypress wetlands, the drainage ditch along the western and southern boundary of the GSU yard, and Calcasieu River sediments. Surface water samples were collected from the drainage ditches, the cypress wetlands and the Calcasieu River. Soil samples were collected along the north fence line and in the cypress wetlands west of the GSU yard.

### ***a. Sediment***

Sediments in the vicinity of GSU include Calcasieu River sediments, the drainage ditches sediment along the western and southern site boundaries, and sediments in the cypress wetlands to the west of GSU. The data from each sediment location is summarized separately.

In September 1992, nine superficial sediment samples were taken from the Calcasieu River, adjacent to River Road and GSU. During the months of January, February, and March 1998, 38 Calcasieu River sediments were collected. They were analyzed for VOCs, PAHs, pesticides, PCBs, and metals. The results are combined and presented in Appendix B, Tables B-6 and B-7. River sediment sampling was designed to determine the horizontal distribution of GSU contaminants from three discharge points into the river. The sediment samples were obtained from the 0- 6 in depth and at the distance of 25, 75, and 200 ft from shore. The sample collected 200 ft from shore was from 33 ft under water. Sediment samples were collected from the immediate areas of the three observed discharge points into the river, as well as locations near the east and west boundaries, and at background locations upstream and downstream from the site. Because no comparison values exist for sediments, soil comparison values were used. Benz(a) pyrene exceeded the ATSDR soil comparison values. Lead exceeded the level considered by the EPA to be protective for soils under a residential use. The maximum concentration of each PAHs was multiplied by its toxicity equivalency factor and summed. The sum is 488 ppm which exceeds the CREG of 0.1 ppm. The highest concentrations of PAHs were detected in the area of the discharge from the former water pipe.

In February 1997, and March 1998, six soil and three ditch sediment samples were collected respectively and analyzed for VOCs, PAHs, pesticides, PCBs, and metals. The west ditch is a narrow, man-made stream, approximately 4 ft wide and less than 6 inches (in) depth. This ditch flows intermittently, carrying water from the south side of the yard and a railroad, around the west boundary, and into the Calcasieu River. In addition, this ditch probably receives seepage water from the wastewater holding pond, southwest of the site. Table B-8 and B-9 in Appendix

B present the analytical results. Benz(a)pyrene and DDE exceeded soil comparison values. Each maximum PAHS concentration was multiplied by its toxicity equivalency factor and summed. The sum equals 2.3 ppm which exceeds the soil comparison value CREG of 0.1 ppm. The PCB, Aroclor 1260, and the DDT breakdown product, DDE, were both detected. No comparison value exists for either compound.

In February 1997 and March 1998, a total of 11 soil and sediment samples were collected from the cypress swamp and analyzed for VOCs, PAHs, pesticides, PCBs, and metals. The cypress wetland is not hydrologically connected to contaminated areas of the GSU yard site. However, during flooding conditions on the Calcasieu River, there is a potential for hydraulic connection between these areas. Normally surface water from the site cannot flow into the area due to topographic obstruction and the west ditch, which collect surface water runoff from the site before it can flow into this area of the cypress wetland.

This data is summarized and presented in Appendix B, Tables B-10 and B-11. Benz(a)pyrene exceeded ATSDR comparison values. The sum of the PAHs multiplied by their Benz(a)pyrene toxicity equivalency factors is 15.7 ppm which is above the CREG of 0.1 ppm as shown in Appendix B, Table 10.

#### *b. Surface Water*

In September 1997, seven surface water samples were collected from the Calcasieu River at the locations of the sediment samples that were the most distant from the shoreline. The water was approximately 33 ft deep at the sample locations. Arsenic (2 - 5 ppb) and thallium (2 - 5 ppb) were the only contaminants present in the Calcasieu River water which exceeded drinking water comparison values. The contaminant levels were lower in the river water than in the ditch and wetlands water. No table was prepared for Calcasieu River water.

In 1997, two surface water samples were collected from the perimeter ditches, one from the west ditch and one from the south ditch. Three surface water samples were collected from the cypress wetland to the west of the GSU property. Results of the ditch and cypress swamp surface water are presented in Table B-12 in Appendix B. The following contaminants exceeded comparison values in one or more samples: bromodichloromethane, dibromochloromethane, Benz(a)pyrene, aldrin, dieldrin, aluminum, arsenic, barium, beryllium, cadmium, chromium, lead, manganese, mercury, nickel, and vanadium. The comparison values are derived for drinking water which assumes adult consumption of two liters of drinking water per day. Cobalt was present, but has no comparison value.

Several of the contaminants detected are not associated with manufactured gas plants and are likely to have come from other sources. The contaminants, bromodichloromethane and dibromochloromethane may be byproducts of drinking water disinfection. The pesticides, aldrin and dieldrin were widely used in the past and could also be from other sources.

### *c. Domestic Well Water*

In April 1999, 25 residential well waters along River Road were sampled. VOCs, semi-volatile organic compound (SVOCs), PCBs, pesticide, metal, and dioxin analysis were performed. The sampling of residential wells identified iron (maximum 2.56 ppm), manganese (0.42 ppm) and sodium as possible contaminants. Sodium was detected at 116 ppm in a residential well water sample. This concentration exceeds the EPA's Drinking Water Equivalent Level (DWEL) of 20 ppm. A DWEL is the lifetime exposure level for drinking water at which adverse, noncarcinogenic health effects would not be expected to occur. Although sodium is a component of table salt and is contained in many foods, the sodium level in the residential well could present a problem to persons who may be on a sodium restricted diet.

The samples were analyzed for dioxins by EPA Method 1613 which achieves a reporting limit of 0.01 nanograms/ liter (ng/L) for 2,3,7,8 tetra-chlorodibenzo-para- dioxin (TCDD) and tetra-chlorodibenzo-para-furan (TCDF). The reporting limit for all other congeners was 0.051 ng/L. Octa-chlorodibenzo-dioxin (OCDD) was detected at a concentration of 0.1100 ng/L in one of the 25 samples. Several dibenzofurans having six and seven chlorines were identified but at concentrations below the method reporting limit. OCDD has a toxicity potential 1000 times lower than 2,3,7,8 TCDD. Dioxins are not a problem in the domestic well water.

Iron and manganese exceeded the EPA's secondary maximum contaminant levels (SMCL). An SMCL is a level at which a concentration which could cause an aesthetic effect such as disagreeable odor or taste, but not likely a health effect. The levels of iron and manganese detected in the drinking water were compared to the recommended dietary allowances (RDA). An estimated iron dose for children was calculated. The levels of iron and manganese in the drinking water do not represent a health concern.

### **3. Physical and Other Hazards**

The GSU site is currently being used as a storage facility for heavy equipment and transformers, etc. Therefore, normal physical hazards posed by this type of equipment are present to workers and visitors on-site. The tar pit is covered with a raised aluminum panel, and may present a physical hazard to workers on-site. The site is fenced entirely and it is unlikely that people would gain unauthorized access to the site.

### **B. Pathway Analysis**

To determine whether nearby residents are exposed to contaminants from the site, OPH and ATSDR evaluate the environmental and human components that lead to human exposure. This pathway analysis consists of five elements: a source of contamination, transport through an environmental medium, a point of exposure, a route of human exposure, and an exposed population.

ATSDR and OPH categorize an exposure pathway as a completed or potential exposure pathway, if the exposure pathway cannot be eliminated. Completed pathways require that the five elements (a source of contamination, transport through an environmental medium, a point of exposure, a route of human exposure, and an exposed population), exist and indicate that exposure to a contaminant has occurred in the past, is currently occurring, or will occur in the future. Potential pathways differ from completed pathways in that at least one of the five elements is missing, but could exist. Potential pathways indicate that exposure to a contaminant could have occurred in the past, could be occurring now, or could occur in the future. An exposure pathway can be eliminated if at least one of the five elements is missing and will never be present. Tables 13 and 14 in Appendix B identify the completed exposure pathways, and the potential exposure pathways, respectively.

The GSU yard has been used for about a century as a manufactured gas plant, fuel oil storage tank site, and landfill. It continues to be an active storage facility with traffic from workers occurring at the site. There are approximately 150 people employed at the site. The facility is located in an industrial area bordered by the Greater Lake Charles Water Company treatment facility. The site consists of east and west service yards separated by North Ryan Street. The west service yard, which is the focus of this report, is used as a storage area and a repair center associated with the Lake Charles service center operations. The area east of North Ryan Street was originally leased for storage. However, it is no longer used and has never been owned by Entergy. Sources of contaminants within the west yard include the six-acre landfill on the western portion of the west yard, the area of the former gas plant in the south central area of the west yard, two unlined oil storage pits in the center of the west yard, and the drainpipe which extends into the Calcasieu River.

Contaminants from the manufactured gas plant are found within the GSU west yard below the gravel fill and outside of the fenced yard in the ditches, the cypress swamp west of the west yard, and the Calcasieu River. Residential areas are located approximately one-half mile to the south and one-quarter mile to the east. The western and northern boundaries of the site are bordered by marsh and the Calcasieu River. Residents live along River Road and pass the site to and from home on a regular basis. In addition, traffic from fishing near the site has been observed.

## ***1. Completed Exposure Pathway***

### ***a. Off-Site Soil and Sediment and Surface Water***

Levels of volatiles and coal tar constituents were detected along the northwest section of the GSU west yard. Overland flow of surface water may have carried contaminants or contaminated soils off of the property. The surface water flow is toward the northwest corner of the site, approximately 60 ft across River Road, to the marsh and river. Contaminated soil and sediment which moved off-site toward the western and southern ditches, cypress wetlands and river located northwest from the site may have contained PCBs, PAHs, and VOCs from the tar pit,

trench, and transformer storage area located in the GSU west yard.

Off-site surface water samples collected from the cypress wetlands and ditches contained PAHs, pesticides, metals, and some chlorinated VOCs at levels above comparison values. Often, these contaminants are widespread in the environment and a source other than the GSU yard is possible. For example, the chlorinated VOCs which were found, are frequently formed during water chlorination. The pesticides found are no longer permitted due to their persistence in the environment, but they used to be widely used to control disease-transmitting insects. Incidental ingestion of surface water could occur if workers had tasks to perform along the ditches or in the cypress wetlands. Incidental ingestion might also occur to older children or adults during recreational activities or play. The amount of water ingested by accident is very small and would occur infrequently. Accidental ingestion of surface water poses no apparent public health hazard.

The western and southern ditches of the west yard receive both west yard and road run off. The ditch sediments contained Aroclor 1260, PAHs, and DDE. The benzo(a)pyrene, Aroclor 1260, and DDE concentrations were below levels characteristic of background levels in the area. Workers who maintain the roads or mow grass, or older children who play in the ditches might come into contact with the ditch soils, sediments, and surface water. Low levels of PAHs and arsenic were found in the soils and sediments in the cypress wetlands. Older children and adults might trespass in the wetlands and be exposed to soils, sediments, and surface waters. Worker exposure would be an infrequent event. Ditch and cypress wetland contaminant levels were below background levels. Because cypress wetlands, soils, and ditch sediments and water contaminant levels are low and exposure to these soils, sediments, and water is infrequent, they pose no apparent public health hazard.

#### *b. Calcasieu River*

Of the areas outside of the GSU west yard, exposure to Calcasieu River sediments is the most likely. The river offers more diverse recreational uses than the cypress wetland or ditches. OPH has seen people fishing on several site visits. Sediment collected from the Calcasieu River showed PAHs contamination which decreased with distance from the shore. PAHs also were transported to the river sediments through the drain pipe which was closed in 1995. Recent sampling has shown that the river water is relatively clean and contaminant levels exceed drinking water comparison values for only two metals, thallium and arsenic. The comparison value assumes that a person drinks two liters of contaminated water daily. Accidental ingestion of water during recreational activities would not come close to the 2 liters per day assumption. Movement of groundwater from beneath the site to surface river water has been noted but a resultant decline in surface water quality has not occurred. Residents living along River Road as well as recreational visitors frequenting the river to fish, and wade in the shallow water or swim, are exposed through dermal contact, ingestion, and inhalation.

The Calcasieu River is an active area for recreational activities such as fishing and swimming, as well as industrial use such as shipping. A Louisiana Department of Environmental Quality

(LDEQ), Department of Natural Resources (DNR), and Department of Health and Hospitals (LDHH) Informational Health Advisory has been in effect since 1993, from the Salt Barrier, located upstream from the site, to the Gulf of Mexico. In spite of this advisory, people are seen fishing directly across from the site or within one-quarter mile downstream of the site [1,11,12]. The Calcasieu River sediments pose a public health hazard due to possible ingestion exposure to lead and to dermal and ingestion exposure to PAHs present.

## ***2. Potential Exposure Pathway***

### ***a. On-Site and Off-Site Air***

VOCs, PAHs, and PCBs are widely distributed throughout the yard, especially toward the northwest corner of the property. Some of these constituents are released into the atmosphere and some bind to soil particles becoming airborne. The presence of gravel fill which averages 4 ft in depth minimizes the generation of dusts. Exposed personnel working on-site and visitors may be exposed to released volatile compounds and contaminants through inhalation, skin contact, and ingestion of these compounds. These contaminants adsorb to dust and soil particles. People could be exposed through ingestion of contaminated dust and soil particles during movement of equipment, digging in the soil, and/or during dry periods when the soil is disturbed by wind and contaminated particles release into the air. Airborne contaminants may have traveled off-site in particles and dust or as vapors. Exposure may have occurred in the past before the fill was brought in and may occur in the future, especially during periods of remedial activity.

### ***b. On-Site Groundwater***

The shallow groundwater beneath the GSU yard is contaminated. Coal tar waste comes into contact with groundwater at 6.5 ft bgs. Coal tar is a mixture of organic contaminants with varying levels of solubility in water so some contaminants are more likely than others to migrate via the groundwater. A shallow well could potentially be drilled on the site which could complete the exposure pathway. This would be highly unlikely however because a delivery system for city water is currently being installed. Exposure to on-site ground water is not a completed pathway because it is not used for any purpose, it does not feed into the deeper aquifers from which drinking water is obtained, and it does not degrade surface water where it discharges to the Calcasieu River.

*c. Off-Site Domestic Well Water*

Within a 1- mile radius of GSU, four residential wells draw from the 200 ft sands of the Chicot aquifer. The city wells in the area draw from the 500 and 700 ft sands. Soil borings, on-site and under the river, show a continuous clay layer that extends across the site and under the river bed which makes it unlikely that site contaminants will migrate through the clay layers to impact the 200 ft sands of the Chicot Aquifer. Testing of residential wells has shown no site contaminants present. Therefore, consumption of contaminated groundwater via a residential well is not a complete pathway because contaminated shallow ground water will not feed the 200 ft sands which are the source of some residential wells.

*d. Biota*

The Calcasieu River is currently under an informational health advisory from the salt water barrier, located across from the GSU site to the Gulf of Mexico. The advisory is the result of hexachlorobenzene (HCB), hexachlorobutadiene (HCBT) and PCBs in fish samples collected in sections of the Calcasieu Estuary, including samples collected from Lake Charles [1]. PCBs were found in the landfill at the GSU west yard. The other fish contaminants are not associated with GSU and are most likely the result of other sources. Presently, signs are posted along the River by GSU which warn of contamination. Consumption of contaminated biota is considered a potential exposure pathway because whether or not people limit their fish meals as a result of the advisory and the level of contamination in the fish is unknown.

*e. On-Site Subsurface Soil*

Three major sources of contamination within the GSU west yard exist. These are the former manufactured gas plant site, two former fuel oil pits, and the 6-acre marsh area used as a landfill to include the trench. VOCs, PAHs, and some metals were found in soil borings to 6.5 ft bgs. PCBs were detected in the mid to northwest section of the site in the area of the exposed tar pit. The subsurface soil is currently covered by two or more ft of gravel to prevent exposure.

Exposure to on-site subsurface soils is a potential exposure pathway because future site operations may require excavation of gravel fill to the depth of the waste. In this case, there is potential for exposure to subsurface soils through ingestion, inhalation and dermal routes.

Workers on-site or people who frequent the yard to obtain supplies would be exposed through dermal, inhalation, and ingestion of contaminants. In the past before the gravel fill barrier was in place, this waste may have been present at the surface so that worker exposure could have occurred. A data gap exists for past worker exposure and trespassers to surface soil contaminants.

### ***3. Eliminated Exposure Pathway***

The surface soil within the service yard has been eliminated as a current and future exposure pathway. The on-site surface soil is covered by two or more ft of gravel fill. The gravel layer prevents exposure of current Entergy service center staff to wastes which lie below the surface. This gravel is maintained and graded regularly by Entergy. The 8 ft fence which surrounds the service yard prevents trespasser exposure to surface soils. The planned surface soil sampling during the RI and EE/CA field activities were not completed. Only seven samples were collected.

## **C. Public Health Implications**

### ***1. Toxicologic Evaluation***

This section will discuss the health effects which could occur in persons who are exposed to specific contaminants, child health issues and address specific community health concerns. To evaluate health effects, ATSDR has developed MRLs for contaminants commonly found at hazardous waste sites. The MRL is an estimate of daily human exposure to a contaminant below which non-cancerous, adverse health effects are unlikely to occur. The MRLs are developed for each route of exposure, such as ingestion and inhalation, and for length of exposure, such as acute (less than 14 days), intermediate (15 - 364 days) and chronic (greater than 365 days). ATSDR presents these MRLs in Toxicological Profiles. These chemical specific profiles provide information on health effects, environmental transport, human exposure, and regulatory status. When MRLs are not available, RfDs provided by the EPA are evaluated.

The exposure scenarios for children were based on an older child (7 years or older) visiting the site to play before the site was fenced off and a young child (1 - 6 years old) playing in contaminated soil in off-site ditches, yards, and around the GSU west yard site. It was assumed that young children would have more adult supervision and would not wander onto the site. For adults, one scenario was for a site employee who worked in the yard for approximately 25 years or more, and the other scenario was for an adult resident living near the site who occasionally visited the site for recreational purposes over a lifetime.

Factors such as duration of exposure, age, and body weight are used to help estimate the amount of contaminant that might have entered a person's body. For example, some young children between the ages of 1-6 years old are known to put everything in their mouth (pica behavior). This behavior increases their chances of being exposed to soil contaminants. This assumption for exposure calculations for a young child is a body weight of 10 kilograms (kg) (approx. 22 pounds), with an ingestion rate of 5,000 mg of soil per day. The assumptions for an older child (seven years or older) are a body weight of 16 kg (approx. 35 pounds) and a soil ingestion rate of 200 mg per day. The adult assumptions are a body weight of 70 kg (approx. 150 pounds), and a soil ingestion rate of 100 mg per day. In addition, the maximum concentration found in a particular media was used for calculating risks and doses, so a worse case scenario was

evaluated.

The health effects which result from the interaction of an individual with a hazardous substance in the environment, depends on several factors. One factor is the route of exposure, for instance, whether the chemical is inhaled, consumed with food or water, or contacts the skin. Another factor is the dose to which a person is exposed, and the amount of the exposure dose that is actually absorbed into the body. Mechanisms by which chemicals are altered in the environment, or inside the body once absorbed, are also important. Many variations in these mechanisms exist between individuals, making them more or less susceptible to adverse health effects.

When performing an exposure assessment, all routes of exposure (ingestion, inhalation, and skin contact) must be considered to determine the overall exposure to a chemical. Because it is difficult to accurately determine the amount of adsorption through the skin, MRLs for skin exposure have not been developed. For this reason, it is difficult to determine the health effects from skin exposure. However, because the levels of many of the chemicals detected are relatively low and since they are generally not widespread, it is unlikely that harmful effects from exposure through skin contact have occurred in the past or will occur in the future, therefore skin contact, as a route of exposure, will not be evaluated further.

### **Polycyclic Aromatic Hydrocarbons (PAHs)**

PAHs are a class of more than 100 different compounds that are found in and formed during the incomplete combustion of coal, oil, wood or other organic substances. In the environment, PAHs are found as complex mixtures of compounds, rarely as single compounds alone. Some uses for PAHs include the manufacture of medicines, dyes, plastics and pesticides. More typically they are found in petroleum-based products such as coal tar and asphalt.

Because they are produced by combustion processes, PAHs are widespread in the environment. In rivers, the majority of PAHs will be bound to sediments. Degradation is slow and is measured in years. Accumulation of PAHs in fish tissue is not a major concern because most fish can metabolize PAHs and excrete them over a few days.

PAHs have been detected in completed pathways including off-site soil, ditch sediments, wetlands soil and sediments and river sediments. PAHs were detected in most of the potential pathways also. The greatest exposures to PAHs for the general population are from inhaling tobacco smoke, wood smoke, and contaminated air, as well as eating contaminated foods. For non-smokers, diet is the largest background exposure to PAHs. Food preparation methods that involve combustion, such as charbroiling or smoking meats or fish, increase exposures to PAHs in food [13]. Occupations where there are significant opportunities for exposure to PAHs include: working with coal tar, asphalt, or roofing materials; working in a foundry; working in a mine, or working as a chimney sweep [13,14].

Non-cancer adverse health effects associated with PAHs exposure have been observed in animals but generally not in humans [13]. Based on the results of animals studies, ATSDR has established several minimum risk levels for oral exposure to individual PAHs. Minimum risk levels are estimates of daily human exposure to a contaminant that is unlikely to cause adverse non-cancer health effects over a lifetime. The MRL for naphthalene of 0.02 milligrams per kilogram of body weight per day (mg/kg-d) is the lowest of all the individual PAHs. It is based on an animal study in which minimal effects on the liver were observed in mice after 90 days of intense exposure to naphthalene by the oral route [13]. For skin contact with PAHs, the main concern is for adverse reactions of the skin. For example, benzo(a)pyrene, the best studied of the PAHs, was found to irritate skin lesions for people with pre-existing skin conditions and to make the skin of animals more sensitive to ultraviolet light [13].

The available evidence indicates that mixtures of PAHs can cause cancer in humans. The evidence in humans comes primarily from occupational studies of workers exposed to mixtures containing PAHs as a result of their involvement in such processes as coke production, roofing, oil refining, or coal gasification (e.g., coal tar, roofing tar, soot, coke oven emissions, coking, crude oil). However, PAHs have not been clearly identified as the causative agent. Cancer associated with exposure to PAHs-containing mixtures in humans occurs predominantly in the lung and skin following inhalation and dermal exposure, respectively [13,14]. The mechanism of action for PAHs carcinogenicity is thought to be that breakdown products formed when PAHs are metabolized by the body are highly reactive with DNA macromolecules, potentially resulting in genetic damage [13].

EPA currently classifies seven of the PAHs as probable human carcinogens based on the weight of toxicological evidence. Benzo(a)pyrene is the best studied of the carcinogenic PAHs, and is the only one for which an oral cancer potency factor has been determined by EPA (7.3 per mg/kg-d) [13]. The potencies of the other six carcinogenic PAHs can be estimated from the potency of benzo(a)pyrene and toxic equivalency factors [13,14]. The overall carcinogenic potential of a mixture of PAHs is often expressed as the benzo(a)pyrene toxic equivalent (TEQ) concentration. This is an estimate of the pure benzo(a)pyrene concentration that would have the same carcinogenic potential as the mixture of PAHs in the sample. The available toxicological evidence indicates that there are no appreciable interactions between different PAHs compounds so adding the effects of multiple PAHs is appropriate [13].

A recent study found that PAHs can pass through the placental barrier between a pregnant woman and the developing fetus [13,14]. There is also some evidence from experiments with animals that exposures to certain PAHs *in utero* can affect reproduction and development; however, the available studies show contradictory results. In Mackenzie and Angevine [13,14], pregnant mice were exposed to benzo(a)pyrene by the oral route during gestation. At the highest dose level, the number of mice giving birth was significantly decreased. Progeny (i.e., offspring) of mice from all the dose levels experienced reproductive problems ranging from decreased fertility to sterility. These results were contradicted by a study performed by Rigdon and Neal [14] in which mice were exposed to benzo(a)pyrene in their diet during mating, gestation, and

childbirth at levels comparable to the first study, but no effects were observed.

Certain people are more susceptible to the toxic effects of PAHs than the general population. Of primary concern are developing fetuses, children, and the elderly, because the detoxification mechanisms used by the body to mitigate the effects of exposure are either immature or declines in function. People with nutritional deficiencies, pre-existing skin or liver disease, genetic diseases that inhibit DNA repair, or compromised immune systems may also be at increased risk. Finally, anyone who is exposed to PAHs from other sources than exposures at the site (e.g., smoking, working with asphalt or coal tar) would be more susceptible because exposures to PAHs are cumulative [13,14].

Noncarcinogenic PAHs at this site include acenaphthene, anthracene, fluoranthene, fluorene, benzo(g,h,i)perylene, naphthalene, and pyrene. Acenaphthene, anthracene, and fluorene are chemical intermediates in dyes, plastics, pesticides, explosives, and chemotherapeutic agents.

Benzo(a)pyrene and other carcinogenic PAHs were detected at concentrations above background levels in on-site subsurface soil and groundwater and Calcasieu River sediment. Studies have found that certain PAHs can cause cancer in animals. Benz(a)pyrene is classified as an EPA group B2 carcinogen, a probable human carcinogen. There are reports of skin tumors among individuals exposed to mixtures of PAHs. These reports provide qualitative suggestions to the potential of carcinogenicity of PAHs. Studies in animals have documented the ability of Benz(a)anthracene, Benz(a)pyrene, Benz(b)fluoranthene, chrysene, and indeno(1,2,3-cd) pyrene to induce skin tumors following intermediate skin exposure. These contaminants are considered complete carcinogens.

The estimated exposure doses were calculated using the maximum concentration for each PAHs detected, Benz(a)pyrene toxic equivalency factors, and the exposure assumptions presented in the Toxicologic Evaluation introduction. By using this approach, the carcinogenic influence of other PAHs can be approximated based on their proportional potency to Benz(a)pyrene.

There is a moderate increase in cancer risk posed to former workers who may have ingested on-site subsurface soil and surface soil. There is no apparent increased cancer risk posed to adults who may trespass on-site and incidentally ingest subsurface soil or surface soil contaminated with PAHs. There is no apparent increased cancer risk to adults with ingesting PAHs-contaminated surface soil and sediments off-site.

### **Napthalene and Methylnapthalene**

Napthalene and methylnapthalene are constituents of coal and coal tar. Napthalene is also isolated from coal tar for industrial use so more toxicological information is available. Napthalene is the main ingredient in mothballs. It is also used for making dyes and pesticides. Exposure napthalene and methylnapthalene can damage the red blood cells resulting in anemia. It has also been associated with adverse effects to the nervous system and the liver [15].

Inhalation of naphthalene can result in respiratory irritation. Naphthalene and methylnaphthalene are not classified with respect to human carcinogenicity.

There is no apparent increased health risk posed to former workers at the site, or adults and children who may trespass on-site and/or come into contact with off-site soils and sediments contaminated with naphthalene and methylnaphthalene.

### **Polychlorinated Biphenyls (PCBs)**

Polychlorinated biphenyls are a group of human-made organic chemicals with many different side chains of chlorinated hydrocarbons which influence the potential level of various harmful effects. They have been widely used as coolants and lubricants in transformers, capacitors and other electrical equipment. Because of their size and water solubility, they do not travel far, but they are persistent in the environment [16]. Of the completed pathways, PCBs were found in the ditch sediments, but at concentrations below the background concentrations. They were also found in the subsurface soil samples taken on the GSU west yard.

Health effects from exposure to PCBs can result in skin irritation, liver, stomach, thyroid gland, and reproductive defects. Some studies have associated PCBs exposure to unborn children and young children with developmental delays. In addition, PCBs have been determined to be a probable human carcinogen [16].

### **Metals**

Metals occur naturally in all soils and sediments. Metals can also be present as the result of industrial processes. Metals which would have been present in coal tar waste include PAHs- benzo(a)pyrene and naphthalene, nonhalogenated semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs)- benzene and metals- arsenic. The off-site surface waters contained amounts of many metals which exceeded either ATSDR comparison values or EPA Maximum Contaminant Levels or Lifetime Health Advisory Levels. These metals include aluminum, arsenic, barium, beryllium, cadmium, chromium, cobalt, lead, manganese, mercury, nickel, thallium and vanadium [17,18,19,21,22,23,24] These concentrations would be a concern if used as a drinking water source. However, ingestion of these waters would be by accident and in very small quantities. Accidental ingestion of river water would be more likely because the river could be used for swimming or other recreational activity. River water was the least contaminated of the various surface waters sampled. No adverse effects would be expected from the accidental ingestion of any of the surface waters.

### **Arsenic**

Arsenic was detected at levels above comparison values in all the completed pathways. Although arsenic was detected in the river, the ditch and wetlands surface water, ingestion of these waters would be by accident and in very small quantities. No adverse effects would be

expected from the accidental ingestion of any of the surface waters [17].

Arsenic was also detected in the off-site soils and sediments. Arsenic is classified as an EPA Group a carcinogen, a known human carcinogen. The cancer risk posed by the levels detected in the soil and sediment was estimated by OPH. It was determined that there is no apparent increased risk of developing cancer over a lifetime from exposure to the levels of arsenic detected in the soil, sediment, or groundwater [17].

### **Lead**

Lead was detected above a residential soil screening level in Calcasieu River sediments. Infants and children exposed to lead can experience negative neurological effects. The amount of exposure to Calcasieu River sediments would be less than exposure to residential soils. Lead in river sediments is unlikely to result in any adverse health effects [18].

### **Thallium**

Thallium is a metal which can be a trace contaminant of coal. It was found in on-site ground water and Calcasieu River water above the Lifetime Health Advisory (LTHA). Thallium ingestion can affect the heart, nervous system and respiratory system [19].

### **Sodium**

Sodium was detected at 116 micrograms per liter (mg/L) in the residential well water sample. This concentration exceeds the EPA's Drinking Water Equivalent Level (DWEL) of 20 mg/L. A DWEL is the lifetime exposure level for drinking water at which adverse, noncarcinogenic health effects would not be expected to occur. Although sodium is a component of table salt and is in many foods, the sodium level in the residential well could present a problem to persons who may be on a sodium restricted diet.

### **Iron and Manganese**

Iron and manganese in residential well water exceeded the EPA's secondary maximum contaminant levels (SMCL). An SMCL is a level at which a concentration which could cause an aesthetic effect such as disagreeable odor or taste, but not likely a health effect. The levels of iron and manganese detected in the drinking water were compared to the recommended dietary allowances (RDA) [20,21]. An estimated iron dose for children was calculated. The levels of iron and manganese in the drinking water do not represent a health concern [21].

## ***2. Child Health Data Evaluation***

Children are at greater risk than adults from certain kinds of exposure to hazardous substances emitted from waste sites. They are more likely to be exposed for several reasons. They play

outdoors more often than adults thus increasing the likelihood that they will come into contact with chemicals in the environment. Due their smaller stature, children may breathe dust, soil and heavy vapors close to the ground. Children who wade or swim may swallow more water and have greater contact with sediments. Children are also smaller, resulting in higher does of chemical exposure per body weight. The developing body systems of children can sustain permanent damage if certain toxic exposures occur during critical growth states. Most important, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care.

Sediments in the Calcasieu River adjacent to the GSU west yard may pose a significant health hazard to older children and young adults since people in these age groups are more likely to swim or water in the river and therefore, would have an increased opportunity for exposure to PAHs in the sediments.

### ***3. Community Health Concerns Evaluation***

The following are the OPH and ATSDR responses to each of the community health concerns

**(1) Signs should be posted to warn people fishing or playing in water and sediment near the site.**

Signs were posted by the EPA in December 1998. The signs define the area of contamination in sediment.

**(2) Many socioeconomic disadvantaged members in the community subsistence fish near the site, especially the water treatment outflow pipe which releases warm, nutrient-rich water into the river, attracting more fish.**

Health education is recommended in the Public Health Assessment to be conducted for this community as well as a fact sheet, explaining the hazards and health effects of the GSU west yard and surrounding area, including the fish consumption advisory in existence for the Calcasieu River system.

**(3) The informational fish and seafood consumption advisory in effect for the Calcasieu Estuary should include recreational activities as well.**

The current EPA signs states “No recreational activity recommended.” This text was selected because it covers all recreational activities including fishing. At present, there is a seafood and fish consumption advisory in effect for the entire Calcasieu Estuary. Areas of contaminated sediments which might merit inclusion in a public health advisory are likely to be localized. The Calcasieu Estuary Initiative includes extensive sediment sampling which will provide more information about the quality of the sediments. OPH recommends that this data be reviewed to determine if any recreational advisories for other locations in the Estuary

are needed.

#### ***D. Health Outcome Data Evaluation***

The Louisiana Tumor Registry (LTR) was used to ascertain cancer cases. The Tumor Registry, operated by Louisiana State University Medical Center, is a population-based cancer registry covering the entire state of Louisiana. The population estimates used are from the U.S. Bureau of the Census. Cancer incidence data is evaluated in Appendix D of this document.

## **V. Site Update**

The Entergy Corporation, under oversight by the U.S. Environmental Protection Agency (EPA), began the site work for the removal action at the Gulf States Utilities/ North Ryan Street site on May 22, 2000. This first phase involved dredging and dewatering river samples. This was completed in July 2000.

Source material and contaminated soils located in the western utility yard known as the “exposed tar area” and the “storm sewer area.” will be cleaned up first. The exposed tar area will be treated using an in-situ thermal treatment process. The contaminated soils in the storm sewer area will be excavated to a depth of five feet, characterized and, following treatment, if deemed necessary, transported to an appropriate off-site disposal facility that is in compliance with the off-site rule. The contingency alternative to the in-situ thermal desorption is excavation and off site treatment or disposal. The storm sewer removal work plan was submitted in December and the work began in early January 2001. The work was completed in February 2001. The in-situ thermal desorption (ISTD) work began in February 2001 with installation of the heater and vacuum wells. A small area was treated first to ensure that the ISTD process would be effective, then the ISTD would be implemented across the whole treatment area.

The success of the ISTD was based, in part, on lowering the groundwater below the thermal desorption zone. Efforts to lower groundwater at the site have been ongoing since March 2001, however, it has been determined that the target groundwater level could not be achieved. Entergy notified EPA in January 2002 that the in-situ thermal desorption was no longer viable. EPA directed Entergy to implement the contingency alternative of excavation and off site treatment or disposal.

The excavation and off site disposal alternative was selected in EPA’s Action memorandum dated June 4, 1999, as a contingency alternative in case the in-situ thermal desorption was not successful. The excavation and off site disposal involves: removal of between 2.5 and 6 feet in the various contaminated areas. They will dig up the contaminated soil which will have a soupy consistency and add something to it to firm it up for disposal. Then collect soil samples from the excavated site. They will then backfill the area with clean soil and geogrid and install an engineered cap. They will conduct air monitoring throughout the entire process.

Entergy is currently modifying the work plans to include the excavation work. The current estimate for starting this work is June 2002. The EPA expects the excavation to be completed by December 2002, and to install an engineered cap by April 2003.

The remedial alternative chosen for Ground Water Operable Unit Number 1, which will be initiated upon completion of the removal action at the exposed tar area, is alternative two. This alternative includes ground water use restrictions, monitored natural attenuation of ground water, surface water and public water supply monitoring.

## **VI. Conclusions**

1. Sediments in the Calcasieu River adjacent to the Gulf States Utilities (GSU) yard present a public health hazard due to the levels of polycyclic aromatic hydrocarbons (PAHs) and possibly lead. People who frequently fish, wade, or swim in the river next to the GSU yard would receive the highest exposure.
2. The cypress wetlands and perimeter ditch sediments have elevated levels of arsenic contamination, but human exposure would be so limited that no apparent public health hazard is present. The diversity of contaminants in the surface water in the wetlands and ditches indicates that contaminants may have come from other sources. As with sediments, exposure is so limited, that there is no apparent public health hazard.
3. Exposure to contaminants within the GSU yard may have occurred in the past. Current worker exposure is prevented by the presence of fill across the yard which averages 4 feet (ft) in depth. Trespasser exposure is prevented by both the fence and the fill.
4. Shallow groundwater beneath the GSU yard contains elevated levels of PAHs and other contaminants. The shallow groundwater discharges to the Calcasieu River but does not impact water quality. A continuous clay layer beneath the shallow groundwater stops the shallow groundwater from traveling to the 200 ft sands which are used to supply drinking water. Analysis of residential wells in the area show that no site related contamination is present.
5. Although the Remedial Investigation (RI) did not include biota sampling, fish sampling data gathered during the Calcasieu Estuary Initiative should be shared with residents. Current information regarding fish consumption includes signs posted at the river by the west yard which warn of possible fish contamination and an informational fish and seafood advisory for the Calcasieu Estuary, including the Lake Charles area.
6. Three of the municipal wells, (G-4, G-6, and G-7) screened in the 700 ft sands and located on the GSU site, have been closed. Five other city wells are located 300 - 400 yards (yds) south from the site on the Lake Charles City Water Department property. Contaminants migrating from the GSU site into groundwater supplies could pose a health threat to the community through ingestion of water from contaminated aquifers in the future.
7. Volatile compounds may create a health threat during periods of remediation if excavated.

## **VII. Recommendations**

1. Entergy should continue to restrict the potential for access to the Gulf States Utilities (GSU) west yard and possible exposure by ensuring that subsurface soils are covered by two or more feet (ft) of gravel fill and by maintaining the fence surrounding the perimeter of the site.
2. The City of Lake Charles should continue with the installation of city well water to the residences who still use private wells in the area.
3. The Environmental Protection Agency (EPA) and Entergy should continue with steps toward remediation.
4. The Office of Public Health (OPH) should remain abreast of EPA Calcasieu Estuary Initiative activities and Agency for Toxic Substances and Disease Registry (ATSDR) dioxin exposure studies so that any information which is relevant to the GSU site can be incorporated in the final Public Health Assessment (PHA).
5. Office of Public Health (OPH) should conduct a public meeting to obtain additional community concerns.
6. Health education should be conducted and a fact sheet on the site prepared to provide information to the community.

### **Health Activities Recommendation Panel (HARP)**

In accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended, the data and information developed in the initial version of the GSU/ North Ryan Street Site Public Health Assessment were evaluated by the Health Activities Recommendation Panel (HARP) for appropriate follow up health activities. The data and information, regarding the exposure to hazardous contaminants and resulting health effects, presented in the initial PHA was reviewed by ATSDR's HARP on January 24, 1996. Many more samples have been gathered since 1996. The EPA Remedial Investigation and Engineering Evaluation/Cost Analysis Report (EE/CA) was completed in February 1998 and Addendum No. 1 completed in March 1999. The 1996 HARP public health actions are provided in the following paragraph. These recommendations are superseded by this document, Public Health Assessment, 2000.

The GSU site poses a public health threat to residents living near the site. The panel suggested conducting community health education and a public health meeting to educate residents of potential exposure to contaminants, aid in assessing adverse health occurrences, and to collect additional community health concerns. This education will focus on the use/nonuse of the river

for fishing and recreational activities and to inform health professionals in the area regarding potential adverse health effects. Several completed pathways exist at this site, including exposure to contaminated soil, sediment, surface water, and air on-site; as well as exposure to contaminated soil, sediment, surface water, and ground water off-site. Data gaps that exist at this site include: exposure through drinking water from contaminated public and private wells, exposure through consumption of contaminated fish, exposure to contaminated water during recreational activities on the river, and exposure to on-site workers through ingestion of contaminated soil particles.

Review of the document indicates that people have been exposed. However, a further exposure investigation is not recommended at this time, until new information becomes available and additional community concerns are obtained. The site will then be further evaluated for the appropriate health actions. A creel survey to assess exposure through fish consumption and a private water well survey is recommended. Concern regarding the increased incidence of lung cancer in the older population has been referred to the Division of Health Studies for further evaluation. As additional information becomes available, the potential for exposure and resultant health effects from the site will be reevaluated.

The following section describes actions taken and planned by the Agency for Toxic Substances and Disease Registry (ATSDR) and/or the Office of Public Health (OPH) at the Gulf States Utilities (GSU) site and surrounding areas. The purpose of this section is to ensure that the public health assessment identifies public health hazards and provides a plan of action to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances found at the site. Included is a commitment by ATSDR/OPH to follow-up on these actions to ensure that they are carried out.

Actions Taken:

- (1) EPA sampled sediments in the river adjacent to the site for contaminants,
- (2) EPA posted signs near the site, regarding hazards of fishing and recreating near the site, particularly near the Municipal Water Treatment Facility outflow pipe and where oily bubbles occur,
- (3) EPA surveyed nearby residents for private drinking water well use,
- (4) GSU continues to restrict the potential for access to the site and possible exposure by maintaining the fence surrounding the perimeter of the site.

Actions to be Taken:

- (1) OPH will obtain more community concerns through a public meeting assisted by the Community Assistance Panel (CAP). A public meeting is to be held to educate and assist the population impacted by the site and survey their potential for exposure to the contaminants of concern. The meeting will include information on the site in the form of a short fact sheet and copies of the health assessment for comment. An "executive summary " of the Public Health Assessment (PHA) will also be available.
- (2) OPH will provide environmental medical education to inform physicians, servicing the exposed community, regarding the contaminants of concern and health issues at this site.
- (3) OPH will share the findings of the ongoing statistical analysis of Calcasieu Parish cancer data.

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## **APPENDICES**

A. Figures

B. Tables

C. Comparison Values

D. Health Outcome Data

## **Appendix A - Figures**

## **Appendix B - Tables**

**Table B-1. Demographics Surrounding the GSU Site in the City of Lake Charles**

<b>TRACT BLOCK GROUPS</b>	<b>TOTAL</b>	<b>CAUCASIAN AMERICAN</b>	<b>AFRICAN AMERICAN</b>	<b>ASIAN AMERICAN</b>
0002-2	416	25 (6%)	390 (94%)	1 (0.2%)
0002-9	52	45 (87%)	7 (13%)	0

1990 U.S. Census data.

**Table B-2. Contaminants detected in on-site subsurface soil to 6.5 ft bgs at Gulf States Utilities, Lake Charles Louisiana. Baseline Risk Assessment, 03/99.**

CONTAMINANT	CONCENTRATION	COMPARISON VALUE		MEAN BACKGROUND
	ppm*	ppm	source	ppm
<b>Volatile Organic Compounds</b>				
Benzene	0.086 - 90	10	CREG†	NA‡
1,3,5-Trimethylbenzene	0.005-35.7	NA		NA
1,2,4-Trimethylbenzene	0.007-441	NA		NA
<b>Polychlorinated Biphenyls (PCBs)</b>				
Aroclor 1016	26	4	RMEG§	NA
Aroclor 1242	0.558 - 533	NA		NA
Aroclor 1248	0.231 - 5.4	NA		NA
Aroclor 1254	0.477 - 200	1	EMEG¶	NA
Aroclor 1260	0.201 - 0.454	NA		NA
<b>Semi-volatile organic compounds</b>				
<i>Benzo(a)pyrene</i>	0.016-1,200	0.1	CREG	NA
Anthracene	0.033-3,500	3000	child RMEG	NA
Acenaphthene	0.130-3,100	3000	child RMEG	NA
Fluoranthene	0.017-9,800	2000	child RMEG	0.192
Fluorene	.017-5,300	2000	child RMEG	NA
Naphthalene	0.24 - 28,000	1000	child inter EMEG	NA
1-Methylnapthalene	0.085-10,000	4000	child EMEG	NA
2-Methylnapthalene	0.082-16,000		NA	NA
Pyrene	.022-8,200	2000	child RMEG	0.193
<b>Metals</b>				
Manganese	14.8-1,430	300	child RMEG	164

\* ppm - parts per million    † CREG - Cancer Risk Evaluation Guide

‡ NA - Not Available    § RMEG - Reference Dose Media Evaluation Guide

¶ EMEG - Environmental Media Evaluation Guide

**Table B-3. Toxicity equivalency factors and product for polycyclic aromatic hydrocarbons detected in GSU west yard on-site subsurface soil to a depth of 6.5 ft below ground surface. Gulf States Utilities, Lake Charles, Louisiana.**

CONTAMINANT	MAXIMUM CONCENTRATION ppm*	TOXICITY EQUIVALENCY FACTOR	PRODUCT
Dibenzo(a,h)anthracene	560	5	2800
Benzo(a)pyrene	1,200	1	1200
Benzo(a)anthracene	2,000	0.1	200
Benzo(b)fluoranthene	1,400	0.1	140
Benzo(k)fluoranthene	1,100	0.1	110
Indeno(1,2,3-cd)pyrene	920	0.1	92
Anthracene	3,500	0.01	35
Benzo(g,h,i)perylene	1,200	0.01	12
Chrysene	2,600	0.01	26
Acenaphthene	3,100	0.001	3.1
Acenaphthylene	5,500	0.001	5.5
Fluoranthene	9,800	0.001	9.8
Fluorene	5,300	0.001	5.3
Phenanthrene	15,000	0.001	15
Pyrene	8,200	0.001	8.2
Benzo(a)pyrene TOXIC EQUIVALENT			4661.9

\* ppm - parts per million

**Table B-4. Contaminants detected in on-site groundwater from wells 8 to 51.5 ft below ground surface in depth at GSU west yard. Gulf States Utilities, Lake Charles, Louisiana. Data sources - Baseline Risk Assessment, March 1999, Groundwater Monitoring Reports, 1998 and 1999.**

CONTAMINANT	CONCENTRATION RANGE ppb*				COMPARISON VALUE	
	1990	1997	1998	1999	ppb	source
<b>Volatile Organic Compounds</b>						
Acetone	NA-<10	<5-<5000	11-11,000	<100	1000	child RMEG†
Benzene	4-25	<1-2600	25-2200	10-1800	0.6	CREG‡
Ethylbenzene	44	28-1500	61-1400	49-960	700	LTHA§
Toluene	NA-10	7-1500	<25-1400	3-1000	200	child EMEG¶
1,3,5-Trimethylbenzene	NA	<1-<1000	4.5-<1000	NA**	NA	
1,2,4-Trimethylbenzene	NA	<1-<1000	1.5-<1000	NA	NA	
Total Xylenes	<5-9	<1-<5000	3.4-<1300	1-720	2000	child EMEG
<b>Semi-volatile organic compounds</b>						
Acenaphthene	8-<10	<0.19-99.9	<1.8-<2700	0.1-550	600	child RMEG
Acenaphthylene	<10	<0.19-4500	<2.3-1900	<0.1-1100	NA	
Anthracene	<10	<0.19-620	0.14-150	0.02-650	3000	child RMEG
Benzo(a)anthracene	<10	<0.19-350	<0.013-60	0.02-410	NA	
Benzo(b)fluoranthene	NA-<10	<0.19-50	<0.018-15	0.03-110	NA	
Benzo(a)pyrene	NA	1-180	30	250	0.005	CREG
Benzo(g,h,i)perylene	0.76	<0.19-84	<0.079-<110	0.03-67	NA	
Benzo(k)fluoranthene	NA-<10	<0.6-<38	0.02-<26	0.02-73	NA	
Chrysene	NA-<10	<0.19-310	<.15-90	0.02-240	NA	
Dibenzo(a,h)anthracene	NA<10???	<1.2-<38	<45	80	NA	
Fluoranthene	NA-<10	<0.19-4300	<0.21-<320	0.03-840	400	child RMEG
Fluorene	NA-<10	<0.19-710	<0.21-220	0.03-880	400	child RMEG
Indeno(1,2,3-cd)pyrene	NA	<0.86-81	<64	80	NA	
Phenanthrene	0.01-<10	<0.19-1800	0.2-420	0.03-2300	NA	
Pyrene	2-<10	<.19-2200	<0.27-140	0.05-1100	300	child RMEG
1-Methylnapthalene	NA	NA	NA	42-1600	700	child RMEG
2-Methylnapthalene	NA	NA	NA	39-1900	NA	
Napthalene	NA-<10	<.38-9400	<18-3000	<2-3900	20	LTHA

CONTAMINANT	CONCENTRATION RANGE ppb*				COMPARISON VALUE	
	1990	1997	1998	1999	ppb	source
<b>Metals</b>						
Arsenic	12.39 - 43.3	2.1 - 27.3	<10 -17.6	NA	50	MCL
Aluminum	344 - 49,400	48.3 - 141,000	<75 - 49,100	NA	20,000	child EMEG
Barium	350 - 738	166 - 3,090	246 -2,890	NA	700	child RMEG
Beryllium	<5.0	<1.0 -8.4	<1.0 - 5.3	NA	4	MCL††
Cobalt	3 - 67	1.6 - 68.1	<7 - 45.4	NA	NA	
Lead	<5.0 - 8.1	<1.0 - 87.1	<5.0 -51.4	NA	10	EPA‡‡
Manganese	801 - 2,230	104 - 6,100	662 - 5,560	NA	500	child RMEG
Nickel	30 -122	<0.1 - 101	<30 - 66.5	NA	100	LTHA
Thallium	NA -<10.0	<0.2 - <150	<10.0 -11.3		0.5	LTHA
Vanadium	11 - 101	<1.0 - 204	<12.0 -91		30	child EMEG

\* ppb - parts per billion

† RMEG - Reference Dose Media Evaluation Guide

‡ CREG - Cancer Risk Evaluation Guide

§ LTHA - Lifetime Health Advisory

¶ EMEG - Environmental Media Evaluation Guide

\*\* NA - Not analyzed

† † MCL - Maximum Contaminant Level

‡ ‡ EPA

**Table B-5. Toxicity equivalency factors and product for polycyclic aromatic hydrocarbons detected in GSU west yard on-site groundwater. Gulf States Utilities, Lake Charles, Louisiana. Data sources - Baseline Risk Assessment, March 1999, Groundwater Monitoring Reports, 1998 and 1999.**

CONTAMINANT	MAXIMUM CONCENTRATION ppb *	TOXICITY EQUIVALENCY FACTOR	PRODUCT
Dibenzo(a,h)anthracene	80	5	400
Benzo(a)pyrene	250	1	250
Benzo(a)anthracene	410	0.1	41
Benzo(b)fluoranthene	110	0.1	11
Benzo(k)fluoranthene	73	0.1	7.3
Indeno(1,2,3-cd)pyrene	81	0.1	8.1
Anthracene	650	0.01	6.5
Benzo(g,h,i)perylene	110	0.01	1.1
Chrysene	310	0.01	3.1
Acenaphthene	<2,700	0.001	2.7
Acenaphthylene	4,500	0.001	4.5
Fluoranthene	4,300	0.001	4.3
Fluorene	880	0.001	0.88
Phenanthrene	2,300	0.001	2.3
Pyrene	2,200	0.001	2.2
Benzo(a)pyrene TOXIC EQUIVALENT (ppb)			744.98

\* ppb-parts per billion

**Table B-6. Contaminants detected in off-site sediments in the Calcasieu River at GSU west yard. Gulf States Utilities, Lake Charles, Louisiana. Data sources - Baseline Risk Assessment, March 1999.**

CONTAMINANT (n=38), March 1998 (n=38) and 1992 (n=9).	CONCENTRATION RANGE	COMPARISON VALUE		MEAN BACKGROUND CONCENTRATION
	ppm *	ppm	source	ppm
Semi-volatile organic compounds				
Benzo(a)pyrene	ND- 240	0.1	CREG†	229
Metals				
Lead	5- 1670	400	EPA ‡	19.5

\* ppm - parts per million

† CREG - Cancer Risk Evaluation Guide

‡ EPA

**Table B-7. Toxic equivalency factors and product for polycyclic aromatic hydrocarbons detected in off-site Calcasieu River sediments at Gulf States Utilities, Lake Charles Louisiana.**

<b>CONTAMINANT October 18, 2000</b>	<b>MAXIMUM CONCENTRATION ppm *</b>	<b>TOXIC EQUIVALENCY FACTOR</b>	<b>PRODUCT</b>
Dibenzo(a,h)anthracene	37	5	185
Benzo(a)pyrene	240	1	240
Benzo(a)anthracene	190	0.1	19
Benzo(b)fluoranthene	140	0.1	14
Benzo(k)fluoranthene	110	0.1	11
Indeno(1,2,3-cd)pyrene	94	0.1	9.4
Anthracene	290	0.01	2.9
Benzo(g,h,i)perylene	130	0.01	1.3
Chrysene	240	0.01	2.4
Acenaphthene	450	0.001	0.45
Acenaphthylene	6.8	0.001	0.0068
Fluoranthene	480	0.001	0.48
Fluorene	150	0.001	0.15
Phenanthrene	1200	0.001	1.2
Pyrene	740	0.001	0.74
Benzo(a)pyrene TOXIC EQUIVALENT			488.03

\* ppm - parts per million

**Table B-8. Contaminants detected in off-site sediments in the west and south ditch at Gulf States Utilities, Lake Charles, Louisiana. Data sources - Baseline Risk Assessment, March 1999.**

. From February 1997 (n=6) and March 1998 (n= 3). CONTAMINANT	CONCENTRATION RANGE	COMPARISON VALUE		MEAN BACKGROUND CONCENTRATION
	ppm *	ppm	source	ppm
Polychlorinated Biphenyls (PCBs)				
Aroclor 1260	ND †- 0.63	NA‡	.68	42.4
Semi-volatile organic compounds				
Benzo(a)pyrene	ND- 1.67	0.1	CREG§	464
Pesticides				
DDE	ND- 0.01	NA		9

\*ppm - parts per million

† ND - not detected

‡ NA - not analyzed

§ CREG -Cancer Risk Evaluation Guide

**Table B-9. Toxicity Equivalency Factors and product for polycyclic aromatic hydrocarbons detected in off-site ditch sediments, Gulf States Utilities, Lake Charles, Louisiana.**

<b>Table- Sediment from the Ditch CONTAMINANT October 18, 2000</b>	<b>MAXIMUM CONCENTRATION ppm*</b>	<b>TOXIC EQUIVALENCY FACTOR</b>	<b>PRODUCT</b>
Dibenzo(a,h)anthracene	.0297	5	<b>0.1485</b>
Benzo(a)pyrene	1.670	1	1.67
Benzo(a)anthracene	1.370	0.1	0.137
Benzo(b)fluoranthene	1.480	0.1	0.148
Benzo(k)fluoranthene	0.672	0.1	0.0672
Indeno(1,2,3-cd)pyrene	0.816	0.1	0.0816
Anthracene	0.517	0.01	0.00517
Benzo(g,h,i)perylene	0.950	0.01	0.0095
Chrysene	2.470	0.01	0.0247
Acenaphthene	NA†	0.001	0.001
Acenaphthylene	0.240	0.001	0.00024
Fluoranthene	4.550	0.001	0.00455
Fluorene	0.364	0.001	0.000364
Phenanthrene	1.110	0.001	0.00111
Pyrene	5.410	0.001	0.00541
Benzo(a)pyrene TOXIC EQUIVALENT			2.30

\*ppm - parts per million

†NA - not available

**Table B-10. Contaminants detected in off-site sediments in the cypress wetland at Gulf States Utilities, Lake Charles, Louisiana. Data sources - Baseline Risk Assessment, March 1999.**

February 1997 (n=10) and March 1998 (n=1). CONTAMINANT	CONCENTRATION RANGE	COMPARISON VALUE		MEAN BACKGROUND CONCENTRATION
	ppm *	ppm	source	ppm
<b>Semi-volatile organic compounds</b>				
Benzo(a)pyrene	ND†- 10.8	0.1	CREG‡	403

\*ppm - parts per million

† ND - not detected

‡ CREG - Cancer Risk Evaluation Guide

**Table B-11. Toxic Equivalency Factors and product for polycyclic aromatic hydrocarbons detected in off-site sediment from the cypress wetland, Gulf States Utilities, Lake Charles, Louisiana.**

<b>CONTAMINANT October 18, 2000</b>	<b>MAXIMUM CONCENTRATION ppm *</b>	<b>TOXIC EQUIVALENCY FACTOR</b>	<b>PRODUCT</b>
Dibenzo(a,h)anthracene	0.538	5	2.69
Benzo(a)pyrene	10.800	1	10.8
Benzo(a)anthracene	8.060	0.1	0.806
Benzo(b)fluoranthene	5.260	0.1	0.526
Benzo(k)fluoranthene	2.490	0.1	0.249
Indeno(1,2,3-cd)pyrene	4.160	0.1	0.416
Anthracene	1.790	0.01	0.0179
Benzo(g,h,i)perylene	2.980	0.01	0.0298
Chrysene	10.200	0.01	0.102
Acenaphthene	1.940	0.001	0.00194
Acenaphthylene	ND	0.001	0.001
Fluoranthene	14.200	0.001	0.0142
Fluorene	0.518	0.001	0.000518
Phenanthrene	2.730	0.001	0.00273
Pyrene	20.800	0.001	0.0208
Benzo(a)pyrene TOXIC EQUIVALENT			15.68

\*ppm - parts per million

**Table B-12. Toxicity Equivalency Factors and product for polycyclic aromatic hydrocarbons detected in off-site ditch surface water and wetland surface water. Gulf States Utilities, Lake Charles, Louisiana.**

CONTAMINANT	MAXIMUM CONCENTRATION ppb *	TOXIC EQUIVALENCY FACTOR	PRODUCT
Benzo(a)pyrene	0.29	1	0.29
Benzo(a)anthracene	0.29	0.1	0.029
Benzo(b)fluoroanthene	0.30	0.1	0.03
Indeno(1,2,3-cd)pyrene	0.16	0.1	0.016
Anthracene	0.69 - 0.74	0.01	0.0074
Benzo(g,h,i)perylene	0.21	0.01	0.0021
Chrysene	0.22 - 0.32	0.01	0.0032
Phenanthrene	0.21 - 0.28	0.001	0.00028
Pyrene	0.28 - 0.58	0.001	0.00058
Benzo(a)pyrene TOXIC EQUIVALENT			0.38

\* Parts per billion

**Table B-12b - Volatile Organic Compounds, Polynuclear Aromatic Hydrocarbons, Pesticides, Metals, detected in off-site ditch surface water and wetland surface water. Gulf States Utilities, Lake Charles, Louisiana.**

CONTAMINANT	CONCENTRATION RANGE	COMPARISON VALUE	
	ppb*	ppb	source
Volatile Organic Compounds			
Bromodichloromethane	2	0.6	CREG†
Dibromochloromethane	2	0.0004	CREG
Polynuclear aromatic hydrocarbons			
Benzo(a)pyrene	0.29	0.005	CREG
Pesticides			
Aldrin	0.003 - 0.014	0.002	CREG
Dieldrin	0.022	0.002	CREG
Metals			
Aluminum	4 - 64,600	20,000	EMEG‡
Arsenic	3 - 70	10	MCL
Barium	225 - 3990	700	RMEG§
Beryllium	10	4	MCL¶
Cadmium	20	2	EMEG
Chromium	2 - 110	100	MCL
Cobalt	40	NA	
Copper	7 - 241	1300	EPA Action Level**
Lead	2 - 460	15	EPA Action Level
Manganese	370 - 9970	500	RMEG
Mercury	0.2 - 3.0	2	MCL
Nickel	2 - 100	100	LTHA††
Vanadium	60 - 110	30	EMEG

\* ppb -parts per billion

† CREG - Cancer Risk Evaluation Guide

‡ EMEG

§ RMEG

¶ MCL

\*\* EPA Action Level    †† LTHA

**Table B-13. Completed Exposure Pathways**

Pathway Name	Source	Medium	Exposure Point	Exposure Route	Receptor Population	Time of Exposure	Exposure Activities	Chemicals
Soil	GSU	off-site soil	soils off-site	Ingestion Inhalation Dermal	Off-site workers and residents	Past Present Future	Work recreational fishing	
Wetlands	GSU west yard/ unknown	surface water and soil/ sediment	Cypress wetlands	Ingestion Inhalation Dermal	Off-site workers and residents	Past Present Future	Work recreational fishing	arsenic (sediment and soil)
Ditch	GSU west yard/ unknown	water and sediments	West ditch/ south ditch	Ingestion Inhalation Dermal	Off-site workers and residents	Past Present Future	Work recreational fishing	arsenic (sediment)
River	GSU	water and sediments	Calcasieu River	Ingestion Inhalation Dermal	Off-site workers, residents, and recreational users of Calcasieu River	Past Present Future	Work recreational fishing	polycyclic aromatic hydrocarbons (PAHs) arsenic, lead,  thallium (water only)

KEY:

\* VOCs - volatile organic compounds    † PAHs - polycyclic aromatic hydrocarbons

‡ PCBs - polychlorinated biphenyls    § HCB- hexachlorobenzene

¶ HCBd - hexachlorobutadiene

**Table B-4. Potential Exposure Pathways**

Pathway Name	Source	Medium	Exposure Point	Exposure Route	Receptor Population	Time of Exposure	Exposure Activities	Chemicals
Air	GSU west yard	air	on or near the site	inhalation of volatile contaminants	workers area residents	past, future, during any digging	breathing	VOCs*, PAHs <sup>†</sup> , PCBs <sup>‡</sup> , metals
Biota	unknown	fish	where the fish are eaten	ingestion	residents and recreational users of Calcasieu River	past present future	eating fish	HCB <sup>§</sup> , HCB <sup>¶</sup> , PCBs
Soil on-site	GSU west yard	soils below the gravel fill	GSU west yard	Ingestion Inhalation Dermal	workers	past, future	work	VOCs, PAHs, PCBs
shallow groundwater	GSU	Residential Well Water	point where groundwater feeds into surface water or at the tap	Ingestion Inhalation Dermal	Off-site residents and recreational users of Calcasieu River	future	domestic activities	VOCs PAHs, PCBs, metals

KEY:

\* VOCs - volatile organic compounds      <sup>†</sup> PAHs - polycyclic aromatic hydrocarbons

<sup>‡</sup> PCBs - polychlorinated biphenyls      <sup>§</sup> HCB- hexachlorobenzene

<sup>¶</sup> HCB<sup>¶</sup> - hexachlorobutadiene

## **Appendix D - Health Outcome Data**

**Table D-1. Standardized Incidence Ratios (SIR) for GSU(Census Tract 0002), 1988-1996. Comparison of Observed and Expected Cancer Incidence Using Louisiana Region V Rates (1988-1992). All Races.**

Cancer Type	Sex	Cases		SIR	p-value
		Observed			
All Cancers	Male	35	28.43	1.23	0.2176
Breast	Female	4	6.96	0.57	0.2620
Colorectal	Male	<3	3.44	-	-
Lung/Bronchus	Male	9	6.99	1.29	0.4475
Prostate	Male	14	7.75	<b>1.81*</b>	0.0249

\* Statistically elevated at the p<0.05 level.

\*\* Statistically low at the p<0.05 level.

**Table D-2. Standardized Incidence Ratios (SIR) for GSU(Census Tract 0002), 1988-1996. Comparison of Observed and Expected Cancer Incidence Using Louisiana Region V Rates (1988-1992). Blacks Only.**

Cancer Type	Sex	Cases		SIR	p-value
		Observed	Expected		
All Cancers	Male	30	30.53	0.98	0.9231
	Female	20	26.31	0.76	0.2185
Breast	Female	4	5.83	0.69	0.4489
Colorectal	Male	<3	3.46	-	-
	Female	3	4.14	0.73	0.5764
Lung/Bronchus	Male	7	7.87	0.89	0.7571
	Female	4	6.21	0.64	0.3750
Prostate	Male	13	8.27	1.57	0.1002

\* Statistically elevated at the  $p < 0.05$  level.

\*\* Statistically low at the  $p < 0.05$  level.